a phase-state changing device situated and configured to change, relative to a standard, a phase state of at least one of the reference-light flux and the measurement-light flux from the target object;

a detector situated and configured to detect interference fringes produced by the interference at any of the various phase states; and

a computer connected to the detector and to the phase-state changing device, the computer being configured to produce, from the detected interference fringes produced at different respective phase states, data concerning respective phase distributions, and to calculate an average phase distribution.

a1 Cont

4. (Amended) The apparatus of claim 1, wherein the phase-state changing device is configured to change the phase state of both the reference-light flux and the measurement-light flux, from the target object, a same amount relative to the standard, while maintaining a constant phase difference between the reference-light flux and the measurement-light flux from the target object.

a2

5. (Amended) The apparatus of claim 1, further comprising a phase-modulation device situated and configured to produce a phase modulation of the measurement-light flux from the target object.

7. (Amended) The apparatus of claim 1, wherein:

a3

the measurement-light flux from the target object has a frequency that is slightly different than a frequency of the reference-light flux; and

the interference is heterodyne interference.

<u>Please cancel claims 11-20 without prejudice.</u>

Please add the following new claims:

64. (New) The apparatus of claim 1, wherein:

the optical characteristic pertains to a surface profile of a reflective target surface of the target object; and

the light-flux optical system is configured to direct the measurement-light flux to the target surface so as to reflect from the target surface, and to establish an interference between the reference-light flux and the measurement-light flux reflected from the target surface.

65. (New) The apparatus of claim 1, wherein:

a16

the optical characteristic pertains to a wavefront aberration profile of the target object; and

the light-flux optical system is configured to direct the measurement-light flux to the target object so as to be transmitted through the target object, and so as to establish an interference between the reference-light flux and the measurement-light flux transmitted through the target object.

Please amend claims 21, 23-24, 26, and 28-31 as follows:

21. (Amended) A method for measuring an optical characteristic of a target object, comprising the steps:

a4

(a) directing a measurement-light flux to the target object so as to cause the measurement-light flux to interact with the target and thus acquire a wavefront profile corresponding to the optical characteristic of the target object;

(b) providing a reference-light flux having a standard wavefront produced by reflection from a standard surface;

(c) establishing a mutual interference between the reference-light flux and the measurement-light flux from the target object;

(d) detecting a respective phase-difference interference pattern produced by the interference;

(e) moving the standard surface and optionally the target object a respective specified distance from a respective standard position and then repeating steps (a)-(d), the respective specified distance being appropriate to change a phase state of the at least one of the light fluxes a specified amount;

a4 cont'd

(f) repeating step (e) to obtain respective phase-difference interference patterns at multiple phase states; and

(g) determining an average phase-difference distribution of the target object from the respective phase-difference interference patterns obtained at the multiple phase states.

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a5

23. (Amended) The method of claim 21, wherein step (e) comprises moving the target object.

24. (Amended) The method of claim 21, wherein step (e) comprises moving both the target object and the standard surface while maintaining a constant phase difference between the reference-light flux and the measurement-light flux.

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a6

26. (Amended) The method of claim 21, wherein;

step (e) comprises moving the target object; and

step (d) is performed by phase-shift interference involving phase modulation of the reference-light flux.

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a7

28. (Amended) The method of claim 21, wherein, in step (e), the at least one of the target object and the standard surface is moved so as to change the phase state in a respective increment, relative to the standard, of 0, $\pi/2$, π, and $3\pi/2$.

29. (Amended) The method of claim 21, wherein, in step (e), the at least one of the target object and the standard surface is moved so as to change the phase state in a respective increment, relative to the standard, of 0, $\pi/4$, $\pi/2$, $3\pi/4$, π, $5\pi/4$, $3\pi/2$, and $7\pi/4$.

30. (Amended) The method of claim 21, wherein, in step (e), the at least one of the target object and the standard surface is moved so as to change the phase state by one or more irregular increments, relative to the standard, of from 0 to 2π and more than 2π as a whole.

a7

Cont

31. (Amended) The method of claim 21, wherein the target object is an optical element.

Please add the following new claim:

a16

66. (New) The method of claim 31, wherein the optical element is a lens element.

Please amend claim 32 as follows:

a8

32. (Amended) An optical element, having an optical characteristic measured using the method of claim 21.

Please add the following new claims:

67. (New) The method of claim 32, wherein the optical characteristic is a wavefront aberration.

a16

68. (New) The method of claim 32, wherein the optical element comprises a target surface having a surface profile measured using the method of claim 21.

Please cancel claim 33 without prejudice.

Please add the following new claims:

69. (New) The method of claim 21, wherein:

a16

the optical property pertains to a surface profile of a reflective target surface of the target object; and

step (a) comprises directing the measurement-light flux to the target surface so as to be reflected from the target surface.

70. (New) The method of claim 21, wherein:

the optical characteristic pertains to a wavefront-aberration profile of the target object; and

step (a) comprises directing the measurement-light flux to the target object so as to be transmitted through the target object.

71. (New) The method of claim 70, wherein, in step (a) the measurement-light flux is directed to the target object so as to be transmitted in a first direction through the target object to a reflection member.

Q 1b Cont

72. (New) The method of claim 71, further comprising reflecting the measurement-light flux, that has been transmitted in the first direction through the target object, so as to cause the measurement-light flux to return through the target object in a second direction.

73. (New) The method of claim 72, wherein step (e) comprises moving the standard surface and optionally the reflection member a respective specified distance from a respective standard position.

<u>Please amend claims 34-37 as follows:</u>

Q9

34. (Amended) The method of claim 72, wherein the step of reflecting the measurement-light flux comprises providing a mirror downstream of the target object so as to reflect the measurement-light flux.

35. (Amended) The method of claim 72, wherein step (e) comprises moving both the target object with reflection member and the standard surface while maintaining a constant phase difference between the reference-light flux and the measurement-light flux.

36. (Amended) The method of claim 72, wherein:

step (d) further comprises modulating the measurement-light flux; and

in step (c) the detected interference is a phase-shift interference.

C9 Cont

37. (Amended) The method of claim 72, wherein;

step (d) further comprises modulating the reference-light flux; and

in step (c) the detected interference is a phase-shift interference.

Please cancel claims 38-43 without prejudice.

Please amend claims 44-46 as follows:

44. (Amended) A projection lens system, comprising the lens element of claim 66.

C10

45. (Amended) A projection lens system, of which the wavefront aberration has been measured using the method of claim 21.

46. (Amended) An apparatus for measuring an optical characteristic of a target object, comprising:

a light source configured to produce a light flux;

a light detector;

an optical system situated relative to the light source and the target object and configured to (i) produce from the light flux a measurement-light flux and a reference-light flux, (ii) direct the measurement-light flux to the target object so as to cause the measurement-light flux to interact with the target object and thus acquire a wavefront profile corresponding to the optical characteristic of the target object, (iii) direct the reference-light flux to reflect from a standard surface so as to provide the reference-light flux with a standard wavefront, (iv) establish an interference between the reference-light flux from the standard surface and the measurement-light flux from the target object, and (v) direct the interfering reference-light flux and measurement-light flux to the detector;

an actuator situated and configured to move the standard surface and optionally also the target object a respective specified distance relative to a respective standard location;

a phase-detection device connected to the detector and configured to detect respective phase differences in the detected light, at the various locations resulting from movement, achieved by the actuator, of the standard surface and optionally the target object over the respective specified distance; and

a computer configured to determine respective phase distributions from the respective phase differences and to calculate, from the respective phase distributions, an average phase distribution, the average phase distribution corresponding to a measurement of the optical characteristic.

Please add the following new claim:

74. (New) The apparatus of claim 46, wherein the optical system directs the measurement-light flux to the target object so as to cause the measurement-light flux to reflect from a target surface of the target object.

Please amend claims 47-50 as follows:

47. (Amended) The apparatus of claim 74, wherein the optical characteristic is a surface profile of the target object.

48. (Amended) The apparatus of claim 74, wherein the actuator is configured to move the target object relative to the respective standard location.

49. (Amended) The apparatus of claim 74, wherein the actuator is configured to move the standard surface relative to the respective standard location.

50. (Amended) The apparatus of claim 74, wherein the actuator is configured to move both the standard surface and the target object relative to the respective standard locations while

maintaining a constant phase difference in the interfering reference-light flux and measurement-light flux.

a4 cont

Please cancel claim 51 without prejudice.

Please add the following new claims:

75. (New) The apparatus of claim 46, wherein the optical system directs the measurement-light flux to the target object so as to cause the measurement-light flux to pass through the target object.

Q16

76. (New) The apparatus of claim 75, further comprising a reflection member situated relative to the target object such that measurement light transmitted in a first direction through the target object reflects from the reflection member and returns via a second direction, opposite the first direction, through the target object to interfere with the reference-light flux.

77. (New) The apparatus of claim 75, wherein the actuator is situated and configured to move the standard surface and optionally at least one of the reflection member and target object a respective specified distance relative to a respective standard location.

Please amend claims 52-54 as follows:

Q12

52. (Amended) The apparatus of claim 75, wherein the optical characteristic is a wavefront aberration of the target object.

53. (Amended) The apparatus of claim 75, wherein the actuator is configured to move the target object, the reflection member, and the standard surface while maintaining a constant distance between the target object, the reflection member, and the standard surface.